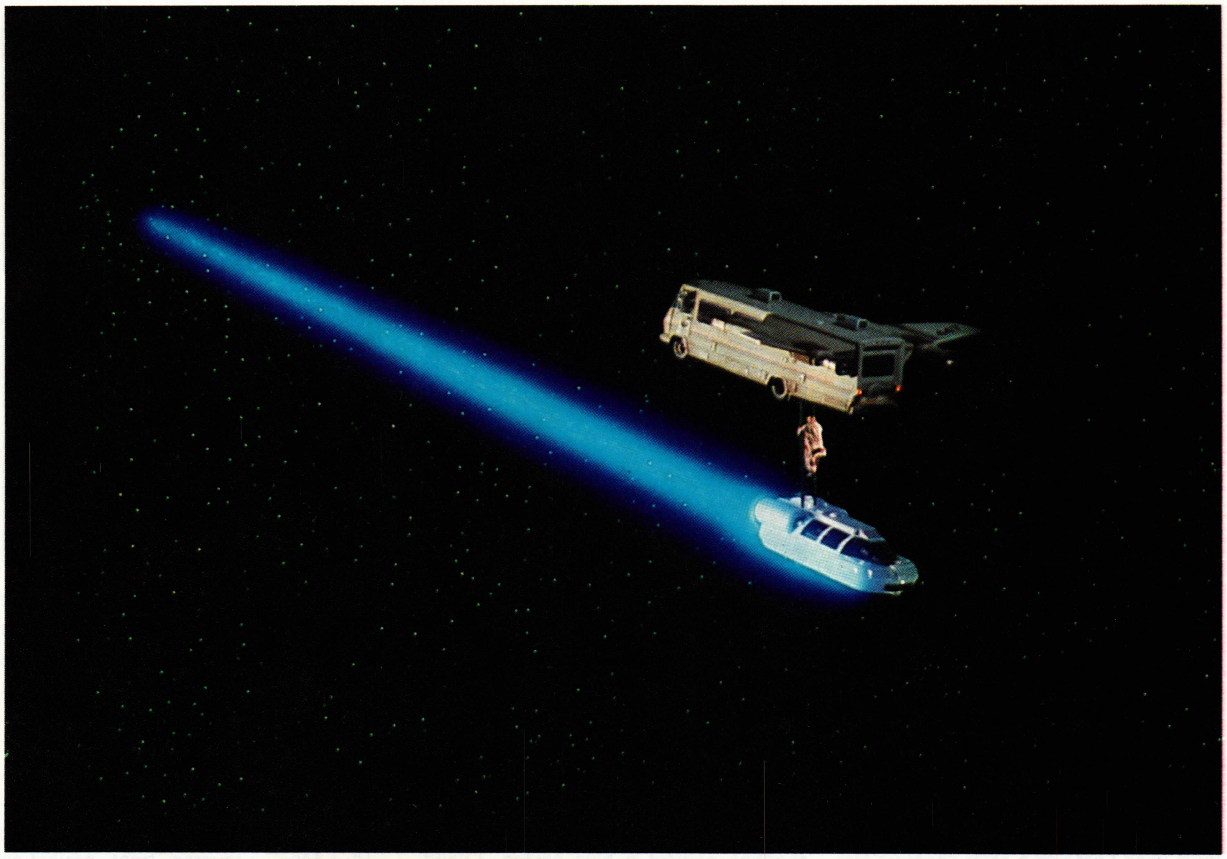


Photos courtesy Apogee, Inc.

**Left:** ***Final composite of scene with John Candy and Eagle V. On following page the elements of the composite are shown.***

# Magic Behind *Spaceballs*

Produced and directed by Mel Brooks
Nick McLean, director of photography
Peter Donen, director of special effects

**by Bob Fisher**

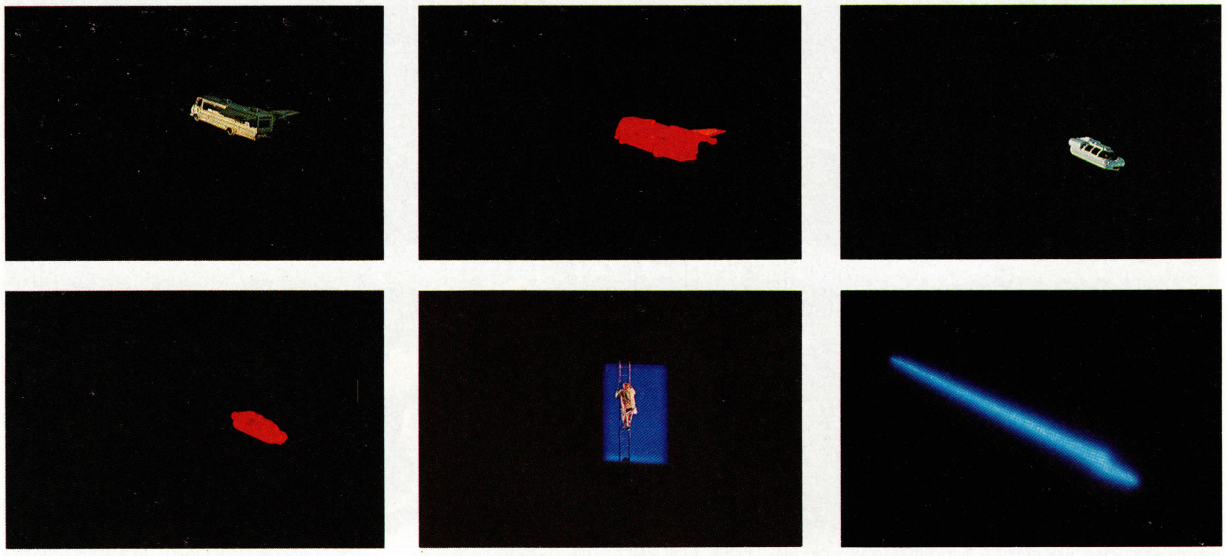
Barf, the almost human, not quite canine companion of Lone Star, a space hero for hire, is climbing into the hatch of an interstellar Winnebago. A starfield background establishes the setting.

That's the illusion movie fans will see, believe and remember. The reality is that John Candy is climbing an 18- to 20-foot-high ladder leading to a set representing the bottom of the Winnebago, which is suspended in the air. Beyond the Winnebago is hanging a 50-foot-wide by 25-foot-high front projection screen. From down on the stage floor, the camera views the scene through the beamsplitter of the "Blue-Max," a high powered blue flux front projector, which fills the large screen with an eerily pure blue light visible only to the camera and its operator. The illusion will come together later when this footage is optically composited with film of the plate – a painted starfield background. The starfield plate is being photographed separately at Apogee,Inc., in Van Nuys, Calif., where the optical composite was also made.

That's just one of some 100 traveling matte composites produced for Mel Brooks' *Spaceballs.*

The Winnebago scene was shot on a sound stage at Lorimar Studios in Culver City, with just 50 foot-candles of key light. Even in that comparatively dim light – for blue screen – visual effects supervisor Peter Donen was able to work at a deep T-4.5 stop.

"The image has to be razor sharp wherever the edge of the matte and the plate touch," says Donen. "If you have soft edges you get 'chatter'



**Clockwise:** ***Eagle V "beauty" pass; Eagle V reverse blue screen matte pass, Honeymoon Coupe "beauty pass;" magnetic beam, live action blue screen element as shot unreduced and masked; and Honeymoon Coupe reverse blue screen matte pass.***

and 'chew' (kind of a flickering effect)."

Depth-of-field is one of the basic tenets of blue-screen photography. Even a little flicker can send a visual signal to the audience that a scene is a composite. And, that's all it takes to ruin an illusion. Until very recently, a visual effects crew shooting in a situation like this would almost certainly have used Eastman's color negative film 5247. Some 200 footcandles of key would be needed for a T-4.5 exposure, and obviously much more for stop T-8 or T-11 – not an unusual requisite.

The problem is that the culture of filmmaking has changed considerably during the past half a dozen years. Most cinematographers are now using high-speed films rated for exposure indices of 300 to 400 for original photography on stages.

"If they have to raise the intensity of lighting for us to shoot a blue screen element, it takes time and affects the pace of production," says Donen. "It costs around $10,000 an hour to relight a set."

*Spaceballs* is the first theatrical feature to make extensive use of the new Eastman color high speed SA negative film 5295, some 40,000 feet of it. The special application film has a recommended exposure index of 400 in 3200 Kelvin tungsten light. It is designed for blue screen work, and it features dimensionally controlled perforations which exceed PS ANSI standards.

Jonathan Erland, Apogee's research and development director, says the new film matches the sensitivity of Eastman's color high speed 5294 and offers grain and sharpness characteristics which come close to matching the medium-speed 5247 film.

If speed is an issue, why not use the 5294 emulsion for blue screen? The main problem is crosstalk between the blue and green layers of the film which causes a fringing effect when shooting against a blue screen, Erland explained. There is also a build-up of grain in the duping process.

"The image characteristics are excellent for original photography, but if you are shooting film for an optical composite, you are adding at least one generation to the process," he says. "Anytime you do this, the grain becomes more apparent in the succeeding generation."

Apogee president John Dykstra notes: "There's no blue-screen shot that you can make with 5295 that you can't do with 5247. But, if you can light for a shot in one to two hours instead of two to three hours, you have time to shoot two takes instead of one. That has creative impact."

One of the *Spaceballs* sets is an interior of a space ship. In one sequence, involving several people, the audience can see moving images through a window in the background which establishes the setting. Here's how director of photography Nick McLean set up that scene: Shooting in the direction of the window, McLean frames a shot over a character's shoulder. He is using the 5295 emulsion since the background is a blue screen. The moving images in the window will be optically composited. Shooting in the other direction, McLean is using the 5294 film. No lighting adjustments are necessary, so the whole flow and pace of production is smoother and faster.

Several techniques were planned for the picture: A front-projection blue-screen using Apogee's award-winning blue flux front projector, the "Blue-Max"; reverse front projection blue screen, a technique developed by Erland and Apogee director of photography John Sullivan; a Stewart "T" matte transmission blue screen; and the oldest and most basic method of all; front-lit blue-screen.

Who and what determines which method is used? "Usually, the special effects supervisor makes the decision regarding choice of blue screen," says Donen. The idea is to shoot the scene as quickly and inexpensively as possible while giving the director the images that he wants. For example, there are a couple of scenes with very reflective surfaces and gold objects. "This is ideal for reverse front projection. Since the beamsplitter is behind the cast there are no problems with reflections."

Logistics plays a part. "Sometimes, we simply needed the 120-foot-wide, 30-foot-high front-lit blue-screen because we had a very big scene," he added. "With reverse front projection we are limited to a finite area since the state of the art of the current technology restricts the height of the beamsplitter (usually a plastic film or pellicle) to about 10 feet."

The main challenge involved in using a blue screen as large as 120-feet wide and 30-feet high is illumination. "Front-lit blue screen requires much higher wattages," Erland says. "Using 'Blue-Max' we could light a front-projection screen that size or larger with only 5,000 watts. In comparison, a front-lit Tempo fabric screen of the same dimensions requires a minimum of 700,000 watts of incandescent light filtered through Lee 119 blue filters."

In addition, Erland adds, the result is a broad band of blue light which contains "an unfortunate amount of green light." In comparison, "Blue-Max" produces pure blue Mercury light.

Erland says that Apogee met this challenge by developing a new type of front-lit blue screen which uses four-by-eight foot panels each densely packed with 24 high-output fluorescent tubes driven by a high-frequency, solid state power supply. Both the tubes and the power supply are new.

"These lamps are 20 times more efficient than incandescent lights, and there is at least one whole stop more separation between the blue and green records (compared to incandescent light used in conjunction with Lee 119 blue filters)," he says.

If everything else is equal, transmission blue light is by far the quickest and easiest way to shoot blue screen sequences. "You plug it in and it's lit," says Donen. "All you do is read the intensity. That's about as fast a setup as there is.

Decisions regarding the use of the 5295 emulsion originated with a preproduction meeting between Donen and McLean. One consideration was the limited availability of the 5295 emulsion when production started. Brooks was planning to shoot with video taps on the camera at all times. "It's a terrific tool for a director like Brooks. Timing and reactions are everything in a comedy like this," says McLean, "so we anticipated that there would be plenty of takes. As a result, we agreed that we would just use the 5295 film that we had for live-action blue screen sequences."

McLean is a native Californian, born and raised in Santa Monica, who came up through the ranks. He worked on about 12 pictures as an operator for Vilmos Zsigmond, ASC, including *Close Encounters of the Third Kind* and *The Deer Hunter,* around half a dozen with Bill Fraker, ASC, and several with Don Peterman, ASC.

McLean became a first cameraman in 1982, when he shot aerial sequences for *The Right Stuff,* and he has gone on to shoot about a dozen features during the past four years including *Short Circuit, The Goonies, Twice in a Lifetime, Stick, City Heat, Staying Alive* and *Stoker.*

The synergy between McLean and Apogee's special effects crew was essential. *"Goonies* and *Short Circuit* had some special effects, but nothing like this," he says.

Most of his films have been noted for low-key, moody lighting. However, *Spaceballs* is "tongue in cheek reality," in McLeans's words. "Mel (Brooks) wanted a bright, up-look. He wanted to be able to see expressions, interactions, the walls, everything."

At the same time, Donen was telling him that he needed to shoot the blue-screen sequences at Lorimar with an aperture of at least stop T-4.5. "I totally trusted Peter (Donen) when he told me about Apogee's tests with the 5295 emulsion, and how it could reduce requirements for lighting intensity," says McLean, "but, I wanted to judge for myself."

It was an objective decision. McLean shot tests side-by-side comparing the 5247 and 5295 emulsions. He liked what he saw in the 5295 film. "The tests showed that we could use a lot less light on blue-screen sequences without noticeably sacrificing color rendition, grain or sharpness. This meant that we could light for live-action and blue-screen work on the same stage at the same intensity."

Normally,for a theatrical feature, Apogee shoots blue screen and other visual effects photography in the eight-perforation VistaVision format. "This gives you about twice the negative area, which translates to a sharper, crisper image when you print down to a 35 mm intermediate," says Donen.

That's significant because the various steps in the blue screen process inevitably degrade the original image by the time the composite is made. There are variations on this theme, but this is how a blue-screen composite for a theatrical feature is typ-

ically created by Apogee: the original VistaVision negative is printed onto three black-and-white separation positives representing the three color layers of the film. Then a high contrast black-and-white positive is made from the original negative using a blue filter.

Next, the "Blue" high-con and the original negative are optically bi-packed and printed with a red filter to produce a high contrast black-and-white matte. The matte, in turn, is contact-printed to produce a reverse or holdout matte. At this point, the image is re-compiled by optically printing the red, green and blue records, respectively, through the high-contrast matte onto an intermediate film. Eastman color inter-negative II film 5243 is usually used for this purpose.

At this point the holdout matte is used to protect the image areas already exposed, while background photography is optically printed onto the same intermediate film. The process could involve many passes through an optical printer since each frame could be a composite of any number of elements.

McLean used four different types of negatives during the production of *Spaceballs,* working with two Panaflex Gold cameras almost all of the time. Because of the nature of the film, coverage was especially important. "There are a lot of close-ups and reaction shots," says McLean. "Some spontaneous reaction shots," says McLean. "Some spontaneous reactions to jokes can never be repeated."

McLean used the 5294 film for interiors on big sets for depth of field, and for night exteriors; the 5247 film for interiors on smaller sets because it's "sharper;" 5295 for live-action blue-screen photography; and the new Eastman color high speed daylight negative film 5297 for daylight exteriors.

"There's a big scene shot in the sand dunes of Yuma, Ariz. (the moon of Vega in *Spaceballs).* "Mel wanted a warm look, and the lab (MGM) recommended the 5297 emulsion," he says. "We shot all day from sun up to sun down. I think the look is a little warmer and a little more defined than the 5247 emulsion."

During the brightest part of the day, McLean used a neutral density number 1.20 filter and worked at stop T-9. "We pretty much stayed in the mid-30s (printer lights) with all four negatives," says McLean. There were no problems intercutting the four negatives in terms of color and other image characteristcs.

Erland explains that previously, miniatures with white or shiny surfaces filmed in front of a blue screen tended to reflect the screen. Also, fine details such as thin wires or antennae were likely to be "wrapped" by the blue light, and would literally disappear in the composite. Since motion control photography makes it feasible to precisely repeat any number of passes in perfect registration, Erland reasoned that the blue screen process could be turned inside out, or reversed.

"Instead of filming an opaque model against an illuminated backing, we could film an illuminated model against a black backing," he explains. "Only things that have fluorescent paint on them will be recorded on film in black light. Everything else is invisible to the camera. Since the painted model is the source of illumination, this process also eliminates problems with reflections on shiny or white surfaces."

This radical departure from the norm does two things. "It's greatly speeded up the process of shooting miniatures," says Erland, "and it has broadened the range of possibilities. For example, it is now possible to matte very shiny and transparent models, even glass. In fact, you can even have blue models. It also allows freer movement of the motion control camera since there is no need to keep the blue camera in the background. And, it has eliminated some of the paraphernalia typically associated with this type of work, such as illuminated pylons."

Actual photography of the model is filmed in white light. Then black light is used to create the matte.

Erland believes that the new film could be used more broadly in the future. "We might have used it for other applications, such as motion control, if we had more stock available when we were creating effects for *Spaceballs,"* he says. "Two stops is the difference between making a two-minute exposure and a 30-second exposure." △